Philosophy. vol 2

K

THOUGHTS

ON

GENERAL GRAVITATION,

And VIEWS thence ariſing

As to the STATE of the UNIVERSE.

> ——*What hinders the fixed Stars from falling upon one another?*
>
> Newton's Optics, 3d Edit. p. 344.

LONDON:
PRINTED FOR T. CADELL IN THE STRAND.
MDCCLXXVII.

G.R. III
BRITISH MUSEUM

PREFACE.

THE following Thoughts took their riſe in the courſe of a philoſophical converſation, about the beginning of the preſent year. Early in the month of February, the Authors read the Paper to ſeveral friends well known in the literary world, and tranſmitted copies of it to others, as opportunities offered of ſo doing. They now ſubmit it to the impartial Public in its original very imperfect ſtate (nothing but the Notes being now added), in order to avoid all interference with Views which may hereafter appear upon the ſame ſubject.

It is the wiſh of the Authors to have the whole conſidered, not as any raſh attempt to indulge an hypotheſis, but merely as hints. To ſome perſons perhaps, the Paper, even in this acceptation of it, may

may appear an unneceſſary and fruitleſs anticipation of diſcoveries, which in proceſs of time may be derived from the obſerved motions referred to in the concluſion of the piece. But to this it may be anſwered, that views founded upon a juſt analogy have on many occaſions led immediately to the fineſt diſcoveries; and for what can be ſhewn to the contrary, the analogy at preſent pointed out, may in ſome way or other ſoon ſuggeſt juſt concluſions from phenomena, which might otherwiſe remain concealed for thouſands of years, were we ſolely to confine ourſelves to the amaſſing of repeated multitudes of obſervations.

It is alſo hoped that a generous and indulgent Public will favourably receive what is now offered, in as far as it ſhall tend to draw the attention of philoſophers to a new and curious field of ſpeculation, and to promote a ſpirit for further reſearches into the great ſcheme of Nature.

THOUGHTS

ON

GENERAL GRAVITATION.

THE laws of motion which regard all bodies, are laid down by Sir Iſaac Newton in four general propoſitions. The firſt three he lays down as axioms, conceiving that they had already been ſufficiently proved by Galileo, Wren, Hugens, Wallace, and others, and only points out the chief heads of the induction, which leads to them. The fourth law, commonly called the Law of Gravitation, he proves by a large and particular induction founded upon the phenomena of our planetary ſyſtem. There appear to be other powers in Nature ſomewhat analogous to that of gravity, but which extend to leſs diſtances, and obſerve different laws of increaſe and decreaſe. For all or for any one of them, it has been found hitherto impoſſible to give any account upon mechanical principles.

In all caſes when bodies ſeem to act upon one another at a diſtance, this force has been called Attraction, and it is well known how many groundleſs objections have been raiſed againſt the Newtonian philoſophy on account of this term.

It might be of uſe always to have it conſidered, that every queſtion concerning the activity or inactivity of matter is not phyſical but metaphyſical. Natural philoſophers commonly take it for granted, that matter is altogether inactive; but it is not of the leaſt moment in phyſics, whether this opinion be true or falſe. Whether matter is acted upon according to certain laws, or whether it acts of itſelf according to theſe laws, makes no difference to the Natural Philoſopher. It is his buſineſs to find the laws which really obtain, and to apply them to the ſolution of phenomena; but whether matter receives theſe laws from ſome external agent, or whether it is itſelf the agent, are queſtions that may be beyond the reach of his faculties, and do not ſo immediately concern his proper buſineſs.

A frame of Nature of any ſort cannot, however, be conceived by the mind, without ſuppoſing matter influenced ſome-how or other by certain active powers or principles of motion. A chaos, or the mere inert materials of a world, would for ever remain without form and void, were not the Spirit of its Almighty Creator to move upon it, ſo as to bring forth beauty and order. It is therefore with great propriety that the illuſtrious Newton has made the buſineſs of a juſt philoſophy to conſiſt in the inveſtigation of thoſe powers and forces, by which the courſe of Nature, to a very wide extent at leaſt, is perpetually governed. The diſcovery of the law of Univerſal Gravitation, to which he was led in philoſophiſing according to this view, will ever be regarded as one of the nobleſt exertions of the human faculties.

The idea of Gravity ſeems to be inſeparable from our notions of any eſtabliſhed order of things. For without a principle of general union obtaining among the parts of matter, we can have no conception of even the very firſt formation of a world. And independent of ſuch a power, the Earth and Sun and Moon, and all the bodies of this ſyſtem, conſidered apart, would be diſpoſed to return into their original chaos, and the order of Nature which takes place in every one of them, would be entirely ſubverted.

But General Gravitation, or that power by which the diſtant bodies appertaining to any ſyſtem do act upon one another, appears not to be ſo neceſſary to the being of that ſyſtem, as particular gravity, ſo to ſpeak, is to the being of any individual of the ſyſtem. We cannot diſcern at leaſt any abſurdity in our conceiving a number of bodies, ſuch as the planets are, to be ſo ſituated in reſpect to another greater body, as to receive from it ſuitable degrees of light and heat, without their having any tendency to approach either that body, or one another. A permanent ſyſtem of quieſcent bodies, appears at leaſt to imply in it no contradiction. How far, however, ſuch a limitation of gravity within a particular diſtance may be a poſſible thing, or how far an indefinite extenſion of that power in every caſe may not be eſſential to its nature, ſeem both to be queſtions which cannot be reſolved until we ſhall be enabled to view gravity as an effect and not as a cauſe.

That this very power, however, which ſeems indiſpenſable to the condition of every individual world or planet conſidered apart, doth in reality extend from every one into the boundleſs void, and to the greateſt aſſignable diſtances, is the great hinge of the Newtonian philoſophy, and is therein fully evinced by the moſt perfect induction. Such an extenſion, therefore, of the power of gravity, muſt, from the nature of the thing, be incompatible with any ſyſtem of bodies which we ſuppoſe to be quieſcent. Did the Sun, for inſtance, and every other body of the ſyſtem, poſſeſs each of them gravity in the limited extent above conſidered, and were they all ſtationary in abſolute ſpace; no ſooner would the influences of general gravitation go abroad into the ſyſtem, than they would all begin mutually to approach, and univerſal deſtruction would at length enſue by the tremendous ſhock of ſo many worlds.

But that the order of the ſyſtem might ſtill be preſerved, and accommodated to the extended influence of that power which ſeems ſo eſſential to the conſtitution of the ſeveral parts, we ſee a moſt admirable contrivance introduced by means of projectile forces. For upon theſe being now adjuſted to, and combined with, thoſe ariſing from general gravitation, the planets would begin to revolve round the Sun in ſtated courſes, by which their continual approach to one another and to the Sun, would be prevented. Upon this very principle it is that the preſent ſyſtem is in reality eſtabliſhed. A proviſion of the ſame kind is obſervable in the ſmaller ſyſtems, of which the Solar one is compoſed. Thus the Moon is a conſtant attendant on the Earth, and as effectually ſo, as ſhe would have been in the caſe of a quieſcent ſyſtem. In the ſame manner the ſatellites of Jupiter and Saturn are found connected with their primaries; the projectile force in all maintaining that order and regularity which would be immediately unſettled were we to ſuppoſe gravitation to act for any time by itſelf.

According to this View, therefore, foraſmuch as gravity ſeems eſſential to the conſtitution of all the great bodies in the Univerſe, and in ſo far as its indefinite extenſion may be inſeparable from its nature, it appears that PERIODICAL MOTION muſt be neceſſary to the permanency and order of every ſyſtem of worlds whatſoever.

But

But here a thought is ſuggeſted which obviouſly leads to a new and very great conception of the Univerſe. For if *Periodical Motion* ſeems thus neceſſary to the preſervation of a ſmall aſſemblage of bodies, and if Newton's law preſents to us the whole Hoſt of Heaven as one great aſſemblage affected by gravitation, it ſeems neceſſary ſtill to have recourſe to Periodical Motion in ſeeking after the eſtabliſhment of this GRAND UNIVERSAL SYSTEM.

For if gravitation knows no boundary, and if all the ſtars obſervable from this our lower world, be in reality ſo many ſuns enlivening other ſyſtems, as is moſt reaſonable to believe, the immenſity of their diſtance cannot ſatisfy us for their being able to remain in any ſettled order. Thoſe of them which are ſituated at and towards the confines of this magnificent creation, muſt forſake their places in abſolute ſpace, and with an approach continually accelerated, move onwards towards the place of general tendency, where, after a certain ſeries of ages, the whole glory

of

of Nature would terminate in one univerſal ruin. But a ſuppoſition ſo injurious to the wiſdom and to the over-ruling power of the Deity, muſt be rejected as derogatory in the higheſt degree.

We have ſeen how projectile force is fitted to counteract the tendency of General Gravitation in a ſmall ſyſtem. With regard to the Earth and Moon, for inſtance, then in the caſe of Jupiter and his ſatellites, and in that of Saturn and his ſatellites, and more generally in that of the ſyſtem at large. As any of the former is but an epitome of that greater ſyſtem to which they belong, may not this in its turn be but a faint repreſentation of that GRAND SYSTEM of the UNIVERSE, round whoſe centre, this Solar Syſtem of ours, and an inconceivable multitude of others like to it, do in reality revolve according to the Law of Gravitation? Agreeable to this, our anticipations of diſorder and confuſion would be changed into the contemplation of an endleſs number of harmonious motions, all of which loudly proclaiming the ſuſtaining hand of the Deity.

Both reaſon and analogy ſeem to draw our views towards a ſtate of things ſo noble and grand. There ſeems a proneneſs in Nature to periſh, if we admit not the ſuppoſition. But the greatneſs of ſuch an Univerſal Syſtem only opens upon us by degrees. We are led onwards to conceptions of ſtill more ſurpaſſing grandeur. If the mediation of ſecond cauſes ſo far obtain, what an inconceivable diſplay of creation is ſuggeſted, when we turn our thoughts towards that place which the motions of ſo many revolving ſyſtems is made to reſpect! Here may be, ſo to ſpeak, an hitherto unthought-of Univerſe of itſelf, an example of material creation, which muſt individually far exceed all the other parts, although added into one amount *, and whoſe remoteneſs, next to

---

* The reader is deſired here to take notice, that this expreſſion is in no wiſe inconſiſtent with the idea of this centre of gravitation being

to infinite, may be conformable to ſome more exalted Nature which it poſſeſſes. Sober reaſon will not be diſpoſed to revolt at ſo glorious an extenſion of the works of God, how much ſoever it be ſuited to overpower our weak conceptions. It may be again repeated, that reaſon and analogy lead towards the thoughts of ſuch a ſcheme of things, and doth not this very analogy acquire an additional weight and

being placed in the middle or within the revolving ſyſtems, ſo as to be ſurrounded by them on all ſides. This was the original notion meant to be conveyed, as will appear by conſidering a little the tenor of the foregoing analogy. To ſuppoſe this centre of gravitation as lying at a diſtance next to infinite, without or beyond them all, would anſwer no purpoſe. This explanation has been now added, from a perſuaſion of there being ſomething obſcure and ill-expreſſed in the above paſſage, as on one particular occaſion it was miſunderſtood by an ingenious Gentleman, to whom ſubjects of this nature are very familiar.

It may here alſo be remarked, that no ſtreſs is laid upon this particular hypotheſis, although purſued a little in the firſt writing out of the Paper; the main drift of which being originally intended to ſuggeſt arguments for the ſtability of the Univerſe, in conſequence of Periodical Motion, any how reconcilable to the Law of Gravitation.

authority

authority from the tranſcendent nature of the material Univerſe at which it points?

But laſt of all, an appeal may be made to arguments ſtill more direct. For, agreeable to all that hath been ſaid, certain † proper motions of the ſtars begin actually to be diſcovered by the nicety of modern obſervations. *Sirius*, *Caſtor*, *Procyon*, *Regulus*, *alpha Aquilæ*, *Pollux*, *Arcturus*, and many others, are found to be all moving through abſolute ſpace with incredible velocity, and the whole ſtars in the firmament are ſuſpected to do ſo, by the firſt aſtronomers of this age. What an aſtoniſhing thing this when conſidered in its proper and full extent! It ſeems the voice of Nature reaching from the uttermoſt heavens, and inviting us to enlarge and elevate our views.

---

† Dr. Halley was the firſt aſtronomer who adverted to theſe motions, and who, from a compariſon of the catalogues of Ptolemy and Flamſtead, ſhewed that the ſtars *Aldebaran*, *Arcturus*, and *Sirius*, had moved half a degree ſouthward in that interval of time. Caſſini, junior, in the year 1738, determined a change of place of *Arcturus* and of *alpha Aquilæ*. Le Monier, in the year 1741, points out the motions of ſeveral others, whoſe places had been determined fifty years before, by Picard and De La Hire. The Rev. Mr. Nevil Maſkelyne, the preſent Aſtronomer Royal, in his late capital publication of his Aſtronomical Obſervations, aſcertains the ſame motions. The late celebrated Tobias Mayer of Gottingen, in his Opera Inedita, printed in the year 1775, gives a catalogue of a great many ſtars, with their variations of place, during the ſpace of fifty years. In ſhort, this matter, which is the moſt wonderful of any in the whole of Aſtronomy, is beyond all manner of doubt.

Let poſterity, therefore, determine, how far the obſerved laws of theſe celeſtial motions, ſhall favour theſe hints of One Grand Univerſal Syſtem.

THE END.